

## CLAIMS

1 1. A method for locating symbols arranged in one or  
2 more rows in an image, the method comprising:  
3 smearing the image;  
4 fitting line segments through edge points of  
5 features in the smeared image;  
6 finding a group of the line segments in mutual  
7 proximity that are mutually substantially parallel; and  
8 identifying a region of the image that contains the  
9 group of the line segments as a possible location of the  
10 symbols.

1 2. A method according to claim 1, and comprising  
2 binarizing the image before smearing it.

1 3. A method according to claim 2, wherein binarizing  
2 the image comprises applying selective binarization so as  
3 to preserve in the binarized image the features of the  
4 image that have stroke widths in a predetermined range  
5 that is associated with the symbols.

1 4. A method according to claim 1, wherein smearing the  
2 image comprises applying a morphological expansion  
3 operator to the features in the image.

1 5. A method according to claim 4, wherein applying the  
2 expansion operator comprises expanding the features in a  
3 plurality of different directions, and selecting one of  
4 the directions so as to minimize a number of runs of  
5 consecutive pixels in the smeared image.

1 6. A method according to claim 5, wherein fitting the  
2 line segments through the edge points comprises fitting  
3 the segments through end points of the runs.

1 7. A method according to claim 1, wherein fitting the  
2 line segments comprises applying a Hough transform to the  
3 edge points.

1 8. A method according to claim 1, wherein fitting the  
2 line segments comprises determining skew angles of the  
3 rows of symbols based on orientations of the line  
4 segments.

1 9. A method according to claim 1, wherein finding the  
2 group of the line segments comprises selecting the line  
3 segments for inclusion in the group based on numbers of  
4 the edge points that are located on each of the selected  
5 line segments.

1 10. A method according to claim 1, wherein finding the  
2 group of the line segments comprises finding end points  
3 of the line segments, and selecting the line segments for  
4 inclusion in the group whose end points are within a  
5 predetermined range of one another.

1 11. A method according to claim 1, wherein identifying  
2 the region comprises selecting a plurality of regions  
3 containing respective groups of the line segments at  
4 different skew angles.

1 12. A computer-implemented method for reading characters  
2 arranged in one or more rows on an object, comprising:

3 capturing an image of the object;  
4 smearing the image;  
5 fitting line segments through edge points of  
6 features in the smeared image;  
7 finding a group of the line segments in mutual  
8 proximity that are mutually substantially parallel;

9 identifying a region of the image that contains the  
10 group of the line segments as a location of the rows of  
11 the characters; and

12 applying optical character recognition to read the  
13 characters in the region.

1 13. A method according to claim 12, wherein the object  
2 comprises a parcel, and wherein the one or more rows of  
3 the characters comprise address information for the  
4 parcel.

1 14. A method according to claim 13, and comprising  
2 sorting the parcel responsive to the address information.

1 15. Apparatus for locating symbols arranged in one or  
2 more rows in an image, comprising an image processor,  
3 which is arranged to smear the image, to fit line  
4 segments through edge points of features in the smeared  
5 image, to find a group of the line segments in mutual  
6 proximity that are mutually substantially parallel, and  
7 to identify a region of the image that contains the group  
8 of the line segments as a possible location of the  
9 symbols.

1 16. Apparatus according to claim 15, wherein the image  
2 processor is arranged to binarize the image before  
3 smearing it.

1 17. Apparatus according to claim 16, wherein the  
2 processor is arranged to binarize the image by applying  
3 selective binarization so as to preserve in the binarized  
4 image the features of the image that have stroke widths  
5 in a predetermined range that is associated with the  
6 symbols.

1 18. Apparatus according to claim 15, wherein the  
2 processor is arranged to smear the image by applying a  
3 morphological expansion operator to the features in the  
4 image.

1 19. Apparatus according to claim 18, wherein the  
2 processor is arranged to expand the features in a  
3 plurality of different directions, and to select one of  
4 the directions so as to minimize a number of runs of  
5 consecutive pixels in the smeared image.

1 20. Apparatus according to claim 19, wherein the  
2 processor is arranged to fit the line segments through  
3 end points of the runs.

1 21. Apparatus according to claim 15, wherein the  
2 processor is arranged to fit the line segments by  
3 applying a Hough transform to the edge points.

1 22. Apparatus according to claim 15, wherein the  
2 processor is arranged to determine skew angles of the  
3 rows of symbols based on orientations of the line  
4 segments.

1 23. Apparatus according to claim 15, wherein the  
2 processor is arranged to select the line segments for  
3 inclusion in the group based on numbers of the edge  
4 points that are located on each of the selected line  
5 segments.

1 24. Apparatus according to claim 15, wherein the  
2 processor is arranged to find end points of the line  
3 segments, and to select the line segments for inclusion  
4 in the group whose end points are within a predetermined  
5 range of one another.

1 25. Apparatus according to claim 15, wherein the  
2 processor is arranged to select a plurality of regions  
3 containing respective groups of the line segments at  
4 different skew angles.

1 26. Apparatus for reading characters arranged in one or  
2 more rows on an object, comprising:

3 an image capture device, arranged to capture an  
4 image of the object; and

5 an image processor, which is arranged to smear the  
6 image, to fit line segments through edge points of  
7 features in the smeared image, to find a group of the  
8 line segments in mutual proximity that are mutually  
9 substantially parallel, to identify a region of the image  
10 that contains the group of the line segments as a  
11 location of the rows of the characters, and to apply  
12 optical character recognition to read the characters in  
13 the region.

1 27. Apparatus according to claim 26, wherein the object  
2 comprises a parcel, and wherein the one or more rows of  
3 the characters comprise address information for the  
4 parcel.

1 28. Apparatus according to claim 27, and comprising a  
2 sorting device, which is arranged to sort the parcel  
3 responsive to the address information.

1 29. A computer software product for locating symbols  
2 arranged in one or more rows in an image, the product  
3 comprising a computer-readable medium in which program  
4 instructions are stored, which instructions, when read by  
5 a computer, cause the computer to smear the image, to fit  
6 line segments through edge points of features in the

7 smeared image, to find a group of the line segments in  
8 mutual proximity that are mutually substantially  
9 parallel, and to identify a region of the image that  
10 contains the group of the line segments as a possible  
11 location of the symbols.

1 30. A product according to claim 29, wherein the  
2 instructions cause the computer to binarize the image  
3 before smearing it.

1 31. A product according to claim 30, wherein the  
2 instructions cause the computer to binarize the image by  
3 applying selective binarization so as to preserve in the  
4 binarized image the features of the image that have  
5 stroke widths in a predetermined range that is associated  
6 with the symbols.

1 32. A product according to claim 29, wherein the  
2 instructions cause the computer to smear the image by  
3 applying a morphological expansion operator to the  
4 features in the image.

1 33. A product according to claim 32, wherein the  
2 instructions cause the computer to expand the features in  
3 a plurality of different directions, and to select one of  
4 the directions so as to minimize a number of runs of  
5 consecutive pixels in the smeared image.

1 34. A product according to claim 33, wherein the  
2 instructions cause the computer to fit the line segments  
3 through end points of the runs.

1 35. A product according to claim 29, wherein the  
2 instructions cause the computer to fit the line segments  
3 by applying a Hough transform to the edge points.

1 36. A product according to claim 29, wherein the  
2 instructions cause the computer to determine skew angles  
3 of the rows of symbols based on orientations of the line  
4 segments.

1 37. A product according to claim 29, wherein the  
2 instructions cause the computer to select the line  
3 segments for inclusion in the group based on numbers of  
4 the edge points that are located on each of the selected  
5 line segments.

1 38. A product according to claim 29, wherein the  
2 instructions cause the computer to find end points of the  
3 line segments, and to select the line segments for  
4 inclusion in the group whose end points are within a  
5 predetermined range of one another.

1 39. A product according to claim 29, wherein the  
2 instructions cause the computer to select a plurality of  
3 regions containing respective groups of the line segments  
4 at different skew angles.

1 40. A product according to claim 29, wherein the symbols  
2 comprise characters, and wherein the instructions cause  
3 the computer to apply optical character recognition to  
4 read the characters in the identified region.

1 41. A product according to claim 40, wherein the image  
2 comprises a parcel, and wherein the one or more rows of  
3 the symbols comprise address information for the parcel.

1 42. A product according to claim 41, wherein the  
2 instructions cause the computer to sort the parcel  
3 responsive to the address information.